10th Class 2017		
Physics	Group-II	Paper-II
Time: 1.45 Hours	(Subjective Type)	Max. Marks: 48

(Part-I)

2. Write short answers to any FIVE (5) questions: 10

(i) Define simple pendulum and write the formula of its time period.

Ans A simple pendulum exhibits simple harmonic motion. It consists of a small bob of mass 'm' suspended from a light string of length 'l' fixed at its upper end.

The time period of a simple pendulum is:

$$T = 2\pi\sqrt{\frac{l}{g}}$$

(ii) Write two characteristics of simple harmonic motion.

Ans Here are two characteristics of simple harmonic motion:

1. A body executing simple harmonic motion always vibrates about a fixed position.
2. Its acceleration is always directed towards the mean position.

(iii) Calculate the frequency of sound wave of speed 340 ms^{-1} and wavelength 0.5 m.

Ans As we know,

$$v = f\lambda$$

$$f = \frac{v}{\lambda}$$

Now, put the values:

$$f = \frac{340}{0.5}$$

$$\boxed{f = 680\ Hz}$$

(iv) Name the two characteristics of sound.

Ans The two characteristics of sound are:

1. Loudness
2. Pitch

(v) Differentiate between frequency and pitch.

Ans

Frequency	Pitch
The number of cycles completed by a sound wave in a unit time is called frequency of that sound.	The characteristic of sound by which we can distinguish between a shrill and a grave sound is called pitch of sound.

(vi) State laws of reflection.

Ans There are two laws of reflection of light:

1. The incident ray, the normal and reflected ray at point of incidence all lie in same plane.
2. The angle of incidence is equal to the angle of reflection.

$$\angle\hat{i} = \angle\hat{r}$$

(vii) What is difference between concave and convex lens?

Ans The lens which causes incident parallel rays to converge at a point is known as convex lens.

Lens causes the parallel rays of light to diverge from a point. This is called concave or diverging lens.

(viii) Define critical angle.

Ans The angle of incidence for which the angle of refraction becomes 90° is called critical angle.

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3. Write short answers to any FIVE (5) questions: 10

(i) Define the unit of electric field intensity.

Ans The SI unit of electric field intensity is newton per coulomb (NC^{-1}).

(ii) Write any two characteristics of electric field lines.

Ans Here are two characteristics of electric field lines:

1. The electric field lines are imaginary lines around a field charge with an arrow head indicating the direction of force.

2. Electric field lines are always directed from positive charge towards negative charge.

(iii) What is meant by electromotive force?

Ans "It is the energy supplied by a battery to a unit charge when it flows through the closed circuit."

Unit: Its unit is volt.

(iv) State Joule's law.

Ans "The amount of energy generated in a resistance due to the flow of charges is equal to the product of square of current, resistance and the time duration."

(v) What is difference between a cell and a battery?

Ans The difference between a cell and a battery is that a cell is a single unit that converts chemical energy into electrical energy, and a battery is a collection of cells.

(vi) Define electromagnet.

Ans The type of magnet which is created when current flows through a coil.

(vii) State Lenz's law.

Ans Lenz's law states that:

"The direction of an induced current in a circuit always opposes the cause that produces it."

(viii) Which device is used for converting electrical energy into mechanical energy and at what principle it works?

Ans D.C motor is such a device which is used for converting electrical energy into mechanical energy. In a practical electric motor, the torque on the armature, and, as a result, the speed of the motor, is controlled by varying the current through the motor.

4. Write short answers to any FIVE (5) questions: 10

(i) Define thermionic emission.

Ans "The process of emission of electrons from hot metal surface is called the thermionic emission."

(ii) **Differentiate between digital and analogue quantities.**

Ans The quantities whose values vary continuously or remain constant are known as analogue quantities while the quantities whose values vary in non-continuous manner are called digital quantities.

(iii) **Construct truth table of AND gate.**

Ans **Truth table:**

The truth table of AND gate is given below:

A	B	X = A.B
0	0	0
0	1	0
1	0	0
1	1	1

(iv) **Differentiate between RAM and ROM.**

Ans Both RAM and ROM are the two parts of primary memory. ROM starts the computer while RAM vanishes when the computer is switched off.

(v) **Write two advantages of e-mail.**

Ans Two advantages of e-mail are:

1. Versatile:

Pictures or other files can also be sent through e-mail.

2. Fast communication:

We can send messages anywhere in world instantly.

(vi) **Define data.**

Ans Data are facts that are used by programs to produce useful information. It may be in form of text, graphic or figure that can be recorded and that have specific meaning.

(vii) **Define fission reaction.**

Ans "A process in which a heavy nucleus breaks into two nearly equal parts with release of energy is called nuclear fission reaction."

(viii) **Write two uses of radio-isotopes.**

Ans Radio-isotopes are used as:

1. Tracers:

In industry, tracers can be used to locate the wear and tear of the moving parts of the machinery. They can be used for the location of leaks in underground pipes.

2. Medical treatment:

Radio-isotopes are also used in nuclear medicines for curing various diseases.

(Part-II)

NOTE: Attempt any TWO (2) questions.

Q.5.(a) How can you define the term wave motion? Also elaborate the difference between mechanical waves and electromagnetic waves with suitable examples. (4)

Ans **Wave motion:**

Wave motion, propagation of disturbances, *i.e.*, deviations from a state of rest or equilibrium from place to place in a regular and organized way.

Difference between mechanical waves and electromagnetic waves:

"Such waves which require a material medium for their propagation are called **mechanical waves**." For example:

1. Water waves.
2. Sound waves.
3. Waves produced in springs and strings.

"Such waves which do not require any material medium for their propagation are called **electromagnetic waves**." For example:

1. Radio waves.
2. Television waves.
3. Heat and light waves.

(b) An object 30 cm tall is located 10.5 cm from a concave mirror with focal length 16 cm. (5)

(i) Where is the image located?
(ii) How high is it?

Ans Given data:

Height of Object = O = 30 cm

Distance = p = 10.5 cm

Focal Length = f = 16 cm

(i)

Here, Image Distance = q = ?

As we know the mirror equation:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

By arranging for 'q', we have

$$\frac{1}{q} = \frac{1}{f} - \frac{1}{p}$$

By putting values, we have

$$\frac{1}{q} = \frac{1}{16} - \frac{1}{10.5}$$

$$\frac{1}{q} = \frac{10.5 - 16}{16 \times 10.5}$$

$$\frac{1}{q} = -\frac{-5.5}{168}$$

$$\Rightarrow \quad q = \frac{-168}{5.5}$$

$$q = -30.54 \text{ cm}$$

The negative sign shows that the image is virtual and forms behind the mirror. However, negative sign will be ignore and q = 30.54 cm.

(ii)

Image height = I = ?

We know the equation:

$$\text{Magnification} = \frac{I}{O} = \frac{q}{p}$$

$$I = \frac{q}{p} \times O$$

By putting values, we get

$$I = \frac{30.54}{10.5} \times 30$$

$$I = 87.26 \text{ cm}$$

Q.6.(a) What are the possible combination of resistors in a circuit? Calculate equivalent resistance for series combination. (4)

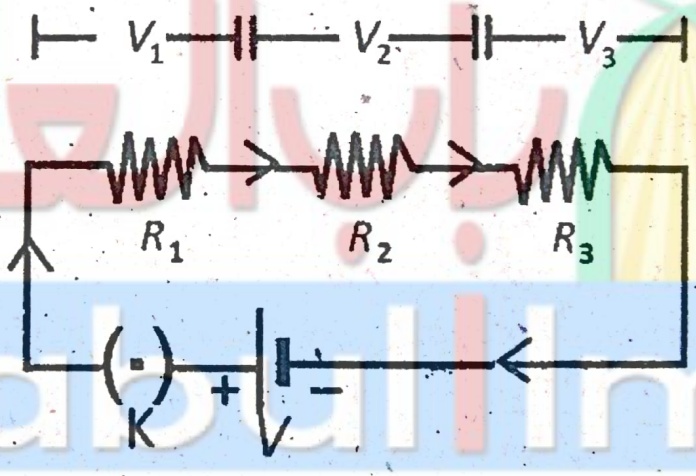
Ans **Combination of Resistors:**

Resistors can be connected in two ways:

(i) Series combination (ii) Parallel combination

(i) Series Combination:

In series combination, resistors are connected end to end and electric current has a single path through the circuit. This means that the current passing through each resistor is the same.



Equivalent Resistance of Series Circuit:

The total voltage in a series circuit divides among the individual resistors so the sum of the voltage across the resistance of each individual resistor is equal to the total voltage supplied by the source. Thus, we can write as

$$V = V_1 + V_2 + V_3$$

where V is the voltage across the battery, and V_1, V_2, V_3 are the voltages across resistors R_1, R_2 and R_3, respectively. If I is the current passing through each resistor, then from Ohm's law

$$V = IR_1 + IR_2 + IR_3$$

$$V = I(R_1 + R_2 + R_3) \quad (1)$$

We can replace the combination of resistors with a single resistor called the equivalent resistance R_e such that the same current passes through the circuit. From Ohm's law

$$V = IR_e$$

Thus, equation (1) becomes

$$IR_e = I(R_1 + R_2 + R_3)$$

$$R_e = R_1 + R_2 + R_3$$

Thus, the equivalent resistance of a series combination is equal to the sum of the individual resistances of the combination.

If resistances R_1, R_2, R_3, ..., R_n are connected in series, then the equivalent resistance of the combination will be given by

$$R_e = R_1 + R_2 + R_3 + ... + R_n$$

(b) Two capacitors of capacitances 12 μF and 6 μF are connected in parallel with a 12 V battery. Find the equivalent capacitance of the combination. Find the charge and the potential difference across each capacitor. (5)

Ans Given data:

$C_1 = 6\ \mu F$

$C_2 = 12\ \mu F$

$v = 12\ v$

To find:

(i) $C_{eq} = ?$

(ii) $Q = ?$

(iii) $V = ?$

Solution:

(i) Since capacitors are connected in series, therefore, equivalent capacitance will be:

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$$

By putting values, we get

$$\frac{1}{C_{eq}} = \frac{1}{6} + \frac{1}{12}$$

$$= \frac{2+1}{12}$$

$$= \frac{3}{12}$$

$$C_{eq} = \frac{12}{3}$$

$$\boxed{C_{eq} = 4\ \mu F}$$

(ii) Since capacitors are connected in series, therefore, charge on each capacitor will be:

$$Q = CV$$

$$Q = 4 \times 10^{-6}\ F \times 12$$

$$= 48 \times 10^{-6}\ F\ V$$

$$\boxed{Q = 48\ \mu C}$$

(iii) Potential difference across capacitor of capacitances C_1 will be:

$$Q = C_1 V_1$$

$$V_1 = \frac{Q}{C_1}$$

$$= \frac{48\ \mu C}{6\ \mu F}$$

$$\boxed{V_1 = 8\ V}$$

Similarly, potential difference across capacitor of capacitance C_2 will be:

$$Q = C_2 V_2$$

$$V_2 = \frac{Q}{C_2}$$

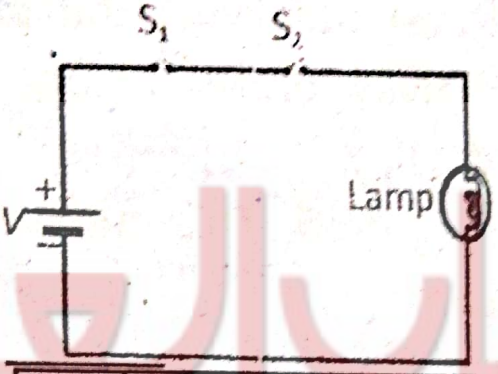
$$V_2 = \frac{48\ \mu C}{12\ \mu F}$$

$$\boxed{V_2 = 4\ V}$$

Q.7.(a) Draw the circuit diagrams of AND operation and OR operation and also write the truth tables of both these operations. (4)

Ans And Operation:

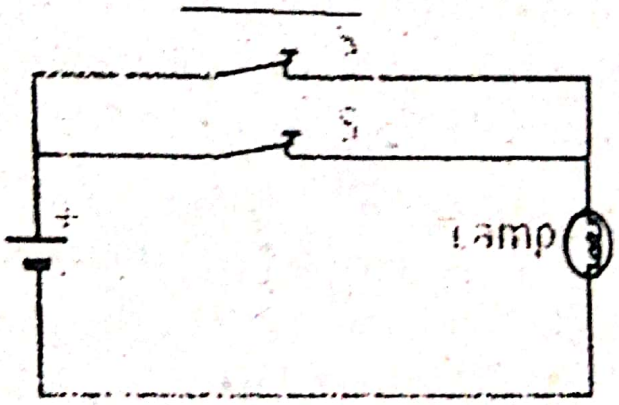
The circuit diagram of AND operation and truth table is given below:



A	B	X = A.B
0	0	0
0	1	0
1	0	0
1	1	1

OR Operation:

The circuit diagram of OR operation and truth table is given below:



A	B	X = A + B
0	0	0
0	1	1
1	0	1
1	1	1

(b) The activity of a sample of radio-active bismuth decreases to one-eighth of its original activity in 15 days. Calculate the half-life of the sample. (5)

Ans Let $T_{1/2}$ is the half-life and A_o is the original activity of the sample. After time $T_{1/2}$ activity will be $A_o/2$. After $2T_{1/2}$ activity will become ½. $A_o/2 = A_o/4$. While after time $3T_{1/2}$, *i.e.*, after three half-lives, the activity will drop to $A_o/8$. It means activity drops to one-eighth of original activity in a time of $3T_{1/2}$.

Therefore, $3T_{1/2} = 15$. This means half-life $T_{1/2}$ of the sample will be 5 days.